Claims:

1. A method for detecting sensor phase in an optical, interferometric sensor array comprising:

transmitting an interrogation signal into a sensor array of sensor elements and a plurality of spaced apart inline reflector sensors, wherein each sensor element comprising the optical transmission path between two inline reflectors;

receiving a reflected signal from the sensor array; and

applying an inverse scattering algorithm to the reflected signal to reduce crosstalk interference.

2. The method of claim 1 further including determining a signal phase delay response of a sensor element.

3. The method of claim 1 further including determining a common mode phase response of a sensor element.

4. The method of claim 1 further including determining a differential birefringent response of a sensor element.

5. The method of claim 1 wherein the interrogation signal comprises at least one signal pulse.

6. The method of claim 1 wherein the interrogation signal comprises a signal having a varying frequency.

7. The method of claim 1 wherein the inverse scattering algorithm comprises:

(a) determining Jones matrices for the sensors in the sensor array;

(b) computing a sensor response for a sensor in the sensor array;

(c) computing a transfer matrix;

(d) determining the forward and backward propagating optical fields from the sensor; and

(e) repeating steps (a), (b), (c) and (d) for each sensor in the sensor array.

8. The method of claim 7 wherein the sensor response includes a signal phase delay response.

9. The method of claim 7 wherein the sensor response includes a common mode phase response.

10. The method of claim 7 wherein the sensor response includes a differential birefringent phase response.

11. The method of claim 1 wherein the inverse scattering algorithm comprises:

computing from the reflected signal an impulse response of the sensor array; and

using the impulse response to define parameters of the inverse scattering algorithm.

12. Apparatus for detecting sensor phase in a sensor array comprising:

a light source for transmitting an interrogation signal into a sensor array having a plurality of spaced apart inline reflector sensors;

a light detector for receiving a reflected signal from the sensor array;

a signal processor for applying an inverse scattering algorithm to the reflected signal that reduces crosstalk interference.

13. The apparatus of claim 12 wherein the signal processor further determines a signal phase delay response between a pair of line reflector sensors.

14. The apparatus of claim 12 wherein the signal processor further determines a common mode phase response of a pair of line reflector sensors.

15. The apparatus of claim 12 wherein the signal processor further determines a

differential birefringent response of a pair of line reflector sensors.

16. The apparatus of claim 12 wherein the interrogation signal comprises at least one signal pulse.

17. The apparatus of claim 12 wherein the interrogation signal comprises a signal having a varying frequency.

18. The apparatus of claim 12 wherein the inverse scattering algorithm computes an impulse response of the sensor array from the reflected signal, and then uses the impulse response to define parameters of the inverse scattering algorithm.

19. A computer readable medium comprising software that, when executed by a processor, causes the processor to process signals reflected from a sensor array using a method comprising:

(a) determining Jones matrices for a sensor within the sensor array;

(b) computing a sensor phase for the sensor;

(c) computing a transfer matrix;

(d) determining the forward and backward propagating optical fields from the sensor; and

(e) repeating steps (a), (b), (c) and (d) for each other sensor in the sensor array.